



Energy Conservation in Buildings and Community Systems Programme -
ECBCS

Energy vs. Sustainability in Buildings: Research Activities within IEA ECBCS

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Executive Committee
Energy Conservation for Buildings and Community Systems

Director, Indoor Environment Research Program
National Research Council Canada



International Energy Agency



Outline

- Mandate of the IEA's Energy Conservation in Buildings and Community Systems
- Sustainability in buildings: today's drivers
- R&D Trends in energy and sustainability of buildings
- Energy vs. Sustainability in ECBCS : strategic approach
- Examples of R&D on sustainable buildings
- NRC's Vision on Sustainable Built Environment



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IEA's Energy Conservation in Buildings and Community Systems

- R&D Collaborative Agreement (1977- now)
 - Primary focus: energy, environment
 - Buildings & communities
- 22 Countries
 - Cost-Sharing of R&D
- Completed 40 research projects
 - 4-Year Project (15-35 Person-year)
- Technology transfer (bookshop, center, etc.)



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Sustainability in Buildings and Communities: Drivers

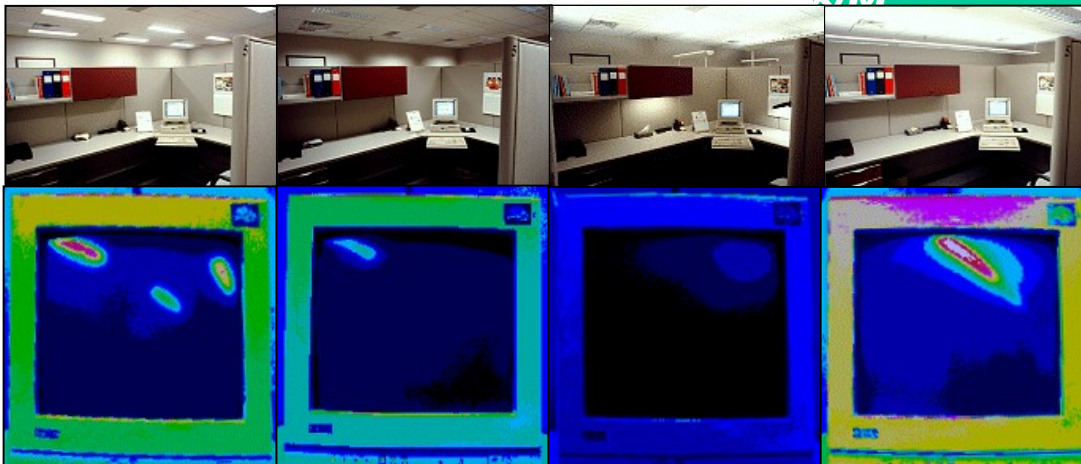
- Buildings = 30-40 % of energy use
- Buildings = 30 % of GHG emissions
- Construction = 25 -40% solid waste
- Construction = + 50 % primary resources
- GDP = 10-15%





Emerging Drivers in the Building Sector

- Indoor health is among WHO's Top 10
- Occupant's satisfaction and quality
- Intelligent buildings



R&D Trends on Sustainable Built Environment

- **Historical emphasis on energy**
- **Recent R&D trends on environment**
- **Moving toward global performance**
- **R&D Gaps**
 - Reliable environment impacts
 - life-cycle & integrated decisions
 - Performance of systems
 - Acceptable limits for occupancy



*Performance
requirements for the
built system*

**Societal
concerns**

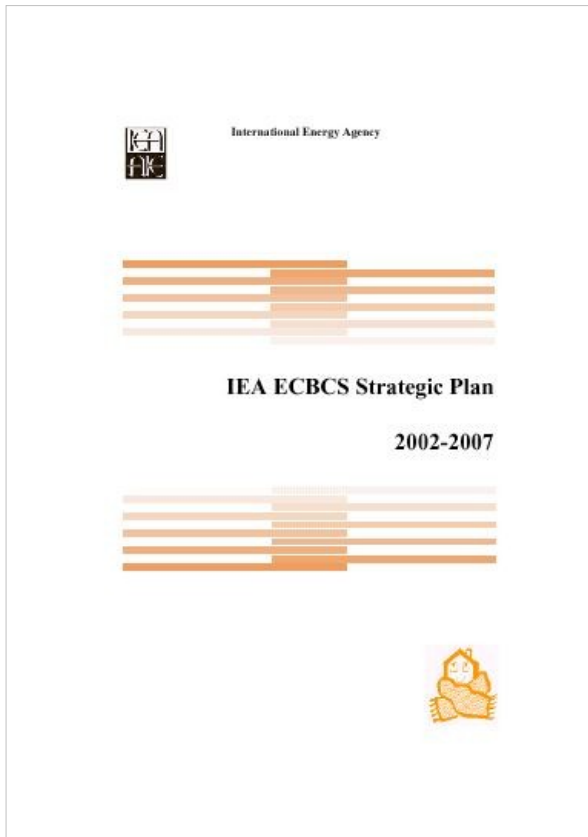
**Economic
concerns**

**Environmental
concerns**



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ECBCS Mission Statement



... to facilitate and accelerate the introduction of **energy conservation and environmentally sustainable** technologies into healthy buildings and community systems,

....through **innovation and research** in decision-making, building products and systems, and commercialization

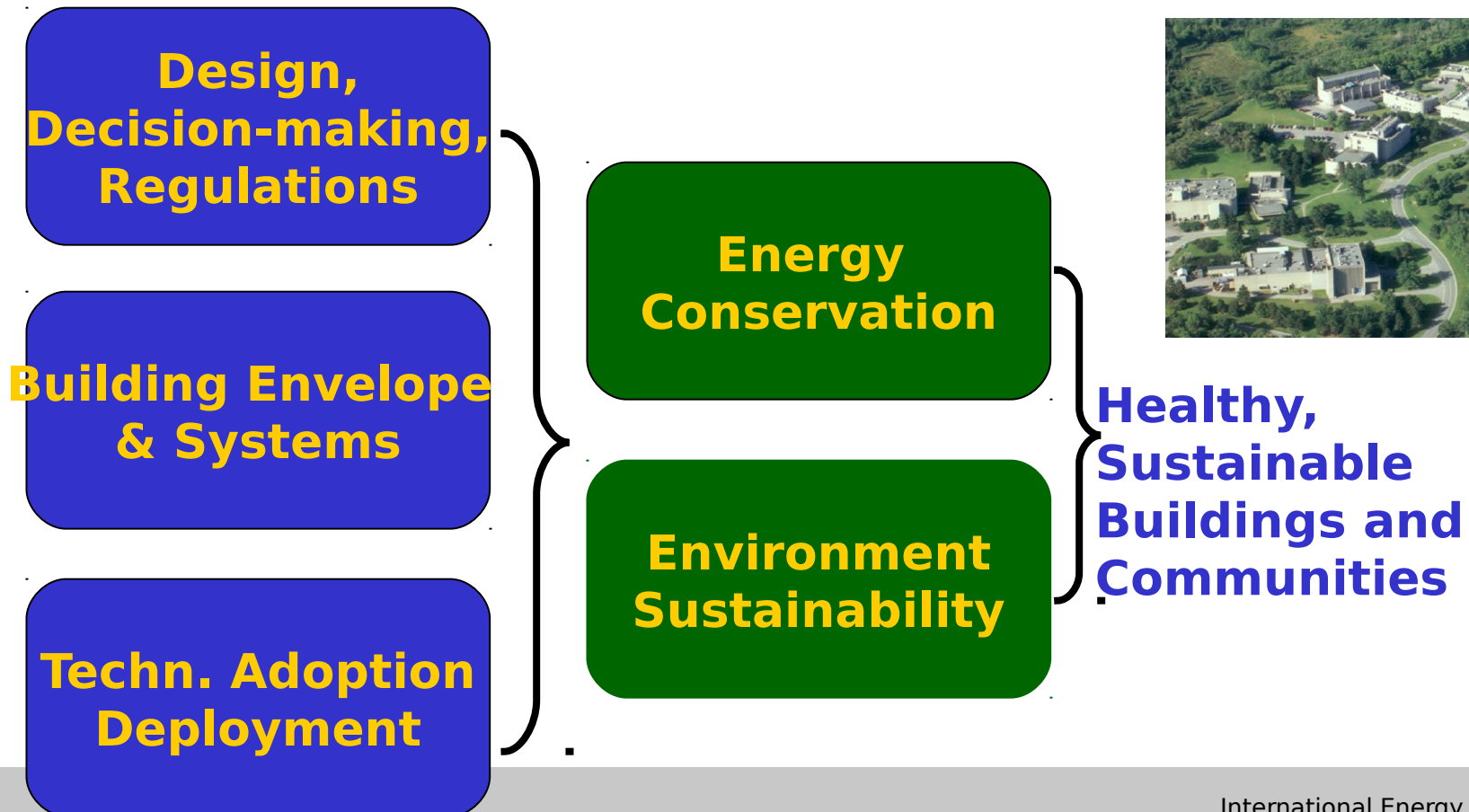


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ECBCS Strategic Plan 2002-2007

Strategies of the Program

The R&D strategies impact buildings and Communities in 3



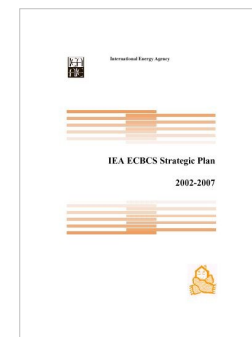


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ECBCS Strategic Plan 2002-2007

Focus

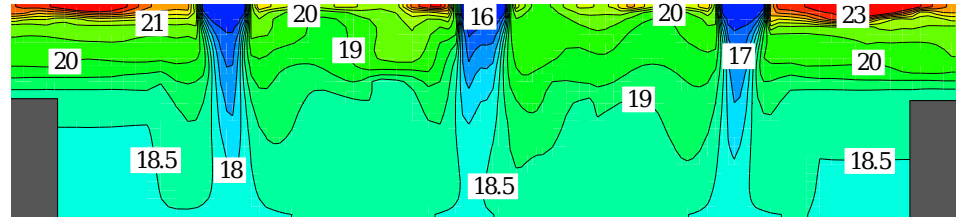
- Performance indicators for sustainability/environmental impacts
- Energy savings for an improved IAQ and satisfaction
- Cost-effective energy retrofit
- Exploiting emerging technologies and IT





The ECBCS Annexes - Overview Products

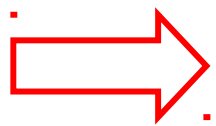
- Decision-making/Design
 - Design Tools, Guides
 - Software, Algorithms
 - Guidelines, Evaluation, Monitoring/Benchmarking
- Building Assemblies and Systems
 - Building Envelope (window, walls)
 - HVAC, Lighting
 - Fuel Cell





Ventilation- Projects & Impacts

- Tools for Inhabitant behaviour with Regard to Ventilation
- Developing Minimum Ventilation Rates
- Performance of Demand Controlled Ventilation Systems



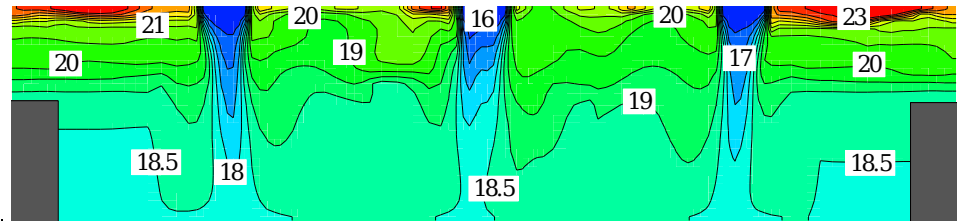
Standards, integrating
energy with occupant's wellbeing





Ventilation- Projects & Impacts

- Air Flow Patterns within Buildings
- Multizone Air Flow Modeling
- Energy Efficient Ventilation of Large Enclosures
- Software to Evaluate Domestic Ventilation Systems
- Hybrid Ventilation



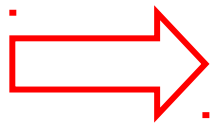
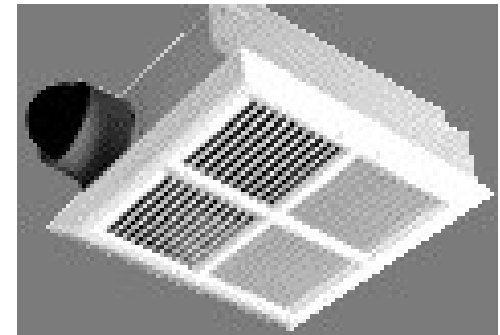
Benchmarking, prediction,
adoption



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HVAC & Energy Management- Projects & Impacts

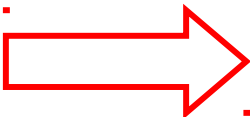
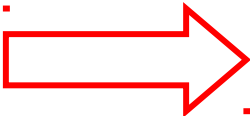
- Building HEVAC Systems Simulation
- Building Energy Management Systems
- User Interfaces and System Integration
- Real Time HVAC Simulation
- Bringing Simulation Models to Engineers
- Computer-Aided Evaluation of HVAC
System Performance



Adopted energy-efficient HVAC
Improved performance prediction



Building Envelope- Projects & Impacts

- Heat, Air and Moisture Transport  Hygrothermal
Properties
of Materials
- Integral Building Envelope
Performance Assessment  Decision-making tool
for total performance
- Windows and Fenestration  Reduction of thermal
loads



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Building Use- Projects & Impacts

- Energy Concept Advisor for energy retrofits of schools → Improved indoor environment & energy performance

Address <http://www.buildingenergyadvisor.com/>

**Retrofit Concept Development**

General Information

The development part is structured in the sectors listed below. A sector can be opened or closed by clicking on its bar. For all needed informations (values, costs etc) default values from national studies are included, but can be changed individually by the user. So please check the default values for your confidence. If you need help while operating click on [?](#)

Additionally there is a manual for the whole Energy Concept Adviser available. [Download manual for ECA](#)

Describe the existing building ? +

Select one retrofit measure for each building element ? -

How to use this part -

This part is for the selection of retrofit measures for each building element, which are going to be retrofitted. The measure with the best cost benefit value is automatically selected. This selection can be changed.

Select a Component: Choose a component and an element, which are going to be retrofitted.

Select a Retrofit Measure: Shows all retrofit measures. Change the chosen measure here by clicking on the checkbox 'Select this measure'.

Overview: Shows the results of the retrofit measures for this element. Each of the measures are calculated related to the unretrofitted building

Select a component -

Main Group	Building envelope	Element	external wall
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Existing Structure

concrete sandwich construction

Applet Energy Concept Adviser started





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Energy-related Environmental Impacts of Buildings



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Energy Conservation in Buildings and Community Systems



Annex 31

LCA METHODS FOR BUILDINGS



LIFE CYCLE OF BUILDING

Annex 31
Energy-Related Environmental Impact of Buildings



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Annex 31

CASE STUDIES

CASE STUDIES OF HOW TOOLS AFFECT
DECISION-MAKING



Annex 31
Energy-Related Environmental Impact of Buildings



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Annex 31

STOCK AGGREGATION

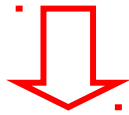
Methods for Evaluation the Environmental
Performance of Building Stocks





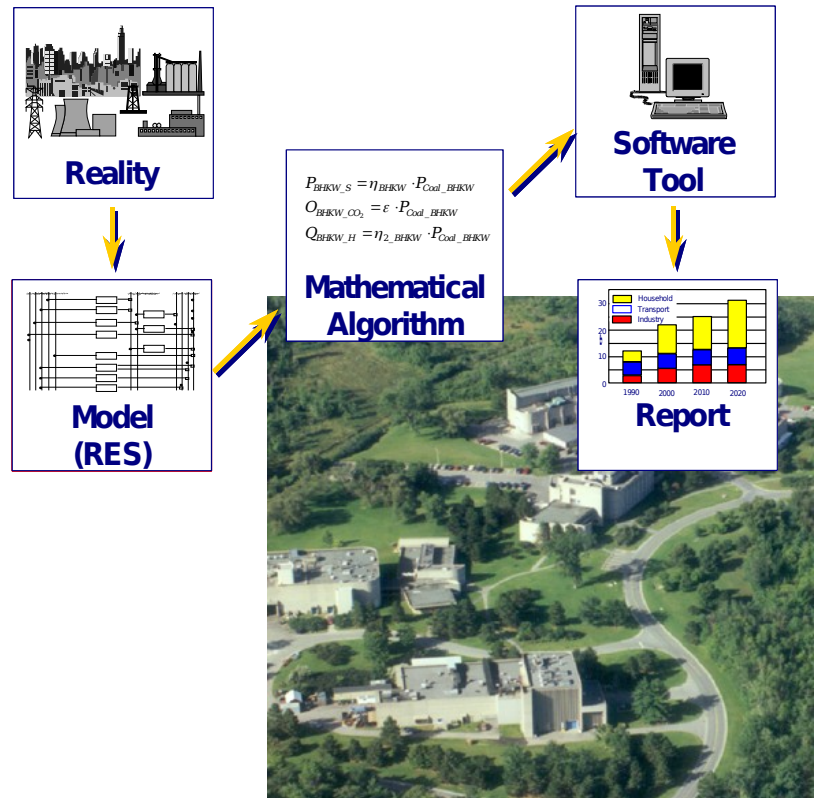
Communities

- Energy Systems and Design of Communities
- Software for Advanced Local Energy Planning



Decision-making tool for
energy-efficient communities

Computer-assisted Modeling





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Achieving Sustainable Buildings (2004-2009)

Integrating Alternate Energy Sources

Low Exergy for Cooling/heating



Annex 37

**Low Exergy Systems for
Heating and Cooling of Buildings**

Annex 37

Participants

Information
for participants

Publications

Links

Presentation of
Annex 37

Fuel cell/Co-Gen-
Cooling/heating



Fuel Cell Technologies

low-valued and environmentally
sustainable energy source

Renewable

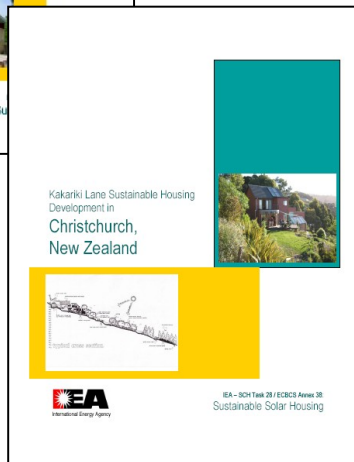
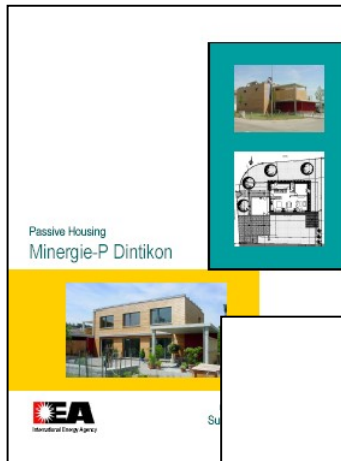


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Achieving Sustainable Buildings (2004-2009)

Integrating Alternate Energy Sources

Market Penetration of Sustainable Solar Housing



○ Marketing guideline

○ Reference Book

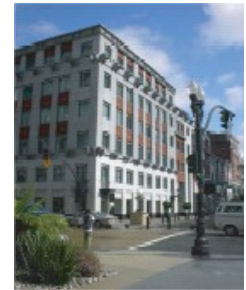
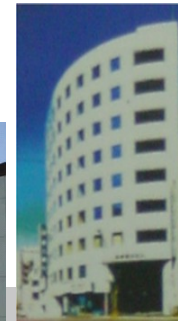
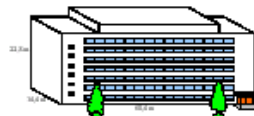
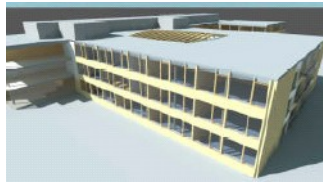
○ Demonstration Projects

International Energy Agency



Achieving Sustainable Buildings (2004-2009) Energy Retrofits-Systems

Optimizing Energy Savings from Commissioning of HVAC Systems



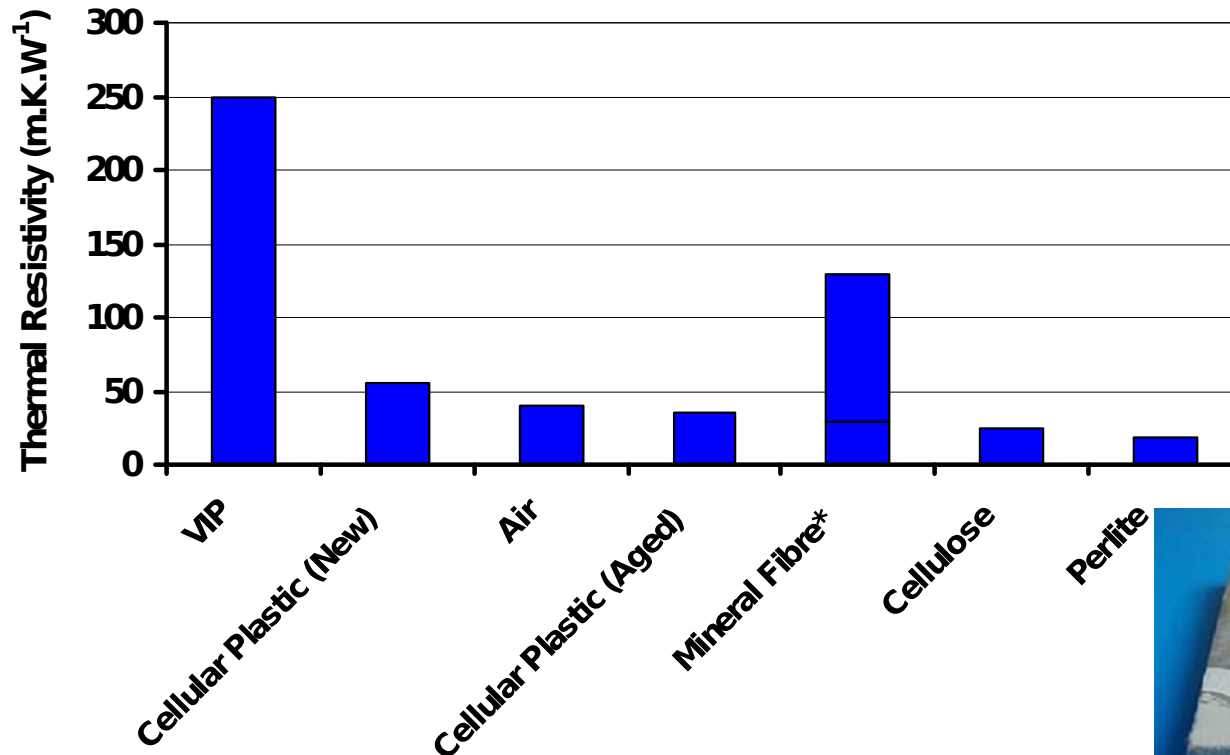


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Achieving Sustainable Buildings (2004-2009)

Innovation in Building Envelope

High Performance Insulation for Buildings

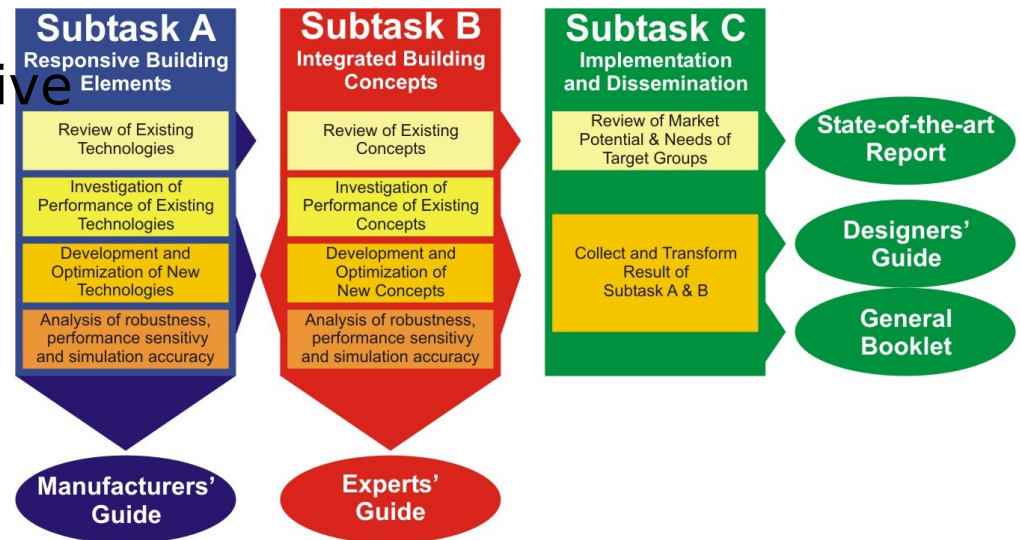




Achieving Sustainable Buildings (2004-2009)

Whole Building- Retrofit

- Integrating Environmentally Responsive Elements in Buildings



- *Holistic Assessment Toolkit - Energy Efficient Retrofit Measures for Government Buildings (EnERGo)*
- Whole Building's Heat, Air, Moisture for Energy Performance

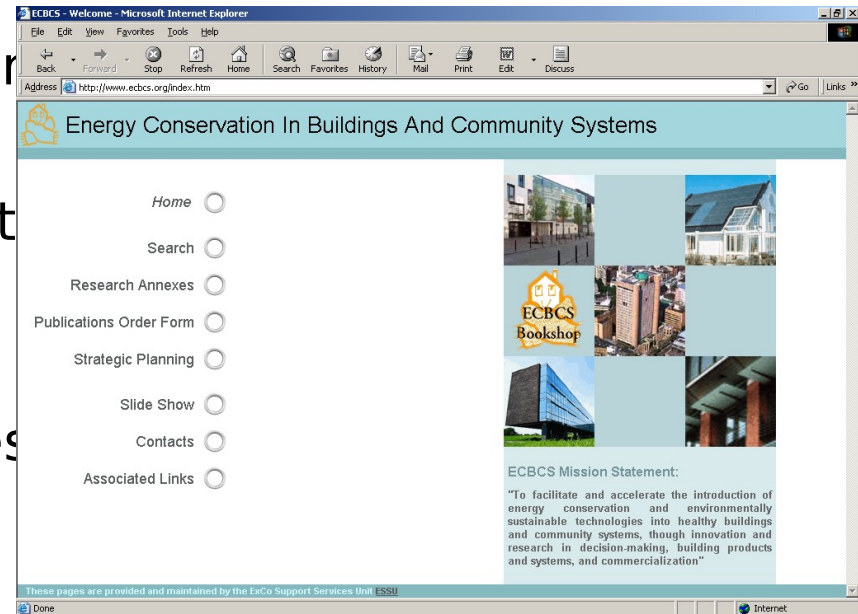


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The ECBCS Annexes - Overview Areas of Application

Outreach and Commercialization

- Air Infiltration and Ventilation Centre (Annex 5)
- ECBCS Bookshop
- Seminars and Conferences
- Demonstration Projects



www.ecbcs.org



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Air Infiltration and Ventilation Centre Publications

All available at www.aivc.org:

- 58 Technical Notes
- 6 Guides
- 12 Annotated Bibliographies
- 10 Ventilation Information Papers
- Quarterly Newsletter: AIR
- 25 Annual Conference Proceedings
- Bibliographic Database with 16000 References

